

Inventors and Scientists: Sir Isaac Newton

By Big History Project, adapted by Newsela staff on 07.30.16

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Portrait of Sir Isaac Newton circa 1715-1720 Photo: Bonhams

Synopsis: Sir Isaac Newton developed the three basic Laws of Motion and stated the Law of Universal Gravitation, which together laid the foundation for our current understanding of physics and the Universe.

Early Life And Education

Isaac Newton was born prematurely on January 4, 1643. After his father died and his mother moved away, he grew up with his grandparents on a farm. As a child he had few playmates, and amused himself by contemplating the world around him.

At school, Newton didn't spend his free time after school playing with the other boys. Instead, he made wooden models, kites, sundials, and even a water clock.

When he was 15, his mother took him out of school to become a farmer. But the director of his school recognized Newton's talents and convinced his mother to let him return to school.

Newton attended Cambridge University from 1661 to 1665. The university temporarily closed soon after he got his degree because people in urban areas were dying from the plague.

Early Discoveries

Newton retreated to his grandparents' farm for two years. During this time, he proved that "white" light was composed of all colors, and started to figure out calculus and universal gravitation — all before he was 24 years old.

Newton was on his grandparents' farm when he sat under the famous apple tree and watched an apple fall to the ground.

He wondered if the force that pulled the apple to the ground could extend out to the Moon and keep it in its orbit around Earth. Perhaps that force could extend into the Universe indefinitely.

After the plague subsided, Newton returned to Cambridge. He earned his master's degree and became a professor of mathematics there. His lectures bored many of his students, but he continued his own thinking and experiments, undaunted. Later, he became the president of the Royal Society of London for Improving Natural Knowledge — the top organization of scientists in England.

Laws Of Motion And Gravity

Newton's most important book was written in Latin; its title was translated as *Mathematical Principles of Natural Philosophy* and was published in 1687.

It proved to be one of the most influential works in the history of science. The book explained Newton's three Laws of Motion and the Law of Universal Gravitation.

Newton used advanced math and observation of the heavens to develop his laws. To track the stars and planets, he used a new type of telescope that he designed and built himself.

Newton's Three Laws of Motion

An object at rest will stay at rest and an object in motion will stay in motion along a straight line unless an external force is applied to it.

An object will accelerate if force is applied to it. The acceleration will happen in the direction of the force. The acceleration will be less as the object gets bigger.

For every action there is always an equal and opposite reaction.

Law Of Universal Gravitation

Putting these laws together, Newton was able to state the Law of Universal Gravitation: "Every particle of matter attracts every other particle with a force proportional to the product of the masses of the two particles and inversely proportional to the square of the distance between them."

Stated more simply, the gravitational attraction between two objects decreases rapidly as the objects get farther apart.

This calculation proved powerful because it presented the Universe as an endless void filled with small objects moving according to rational principles.

Everything, from apples to planets, obeys the same unchanging laws. By combining physics, mathematics, and astronomy, Newton made a giant leap in human understanding of Earth and the cosmos.

Calculus

Newton's mathematical method for dealing with changing quantities is now called calculus. Newton did not publish his method, but solved problems using it.

Later, the German scientist Gottfried Wilhelm von Leibniz also worked out calculus, and his notation proved easier to use. Newton accused Leibniz, in a nasty dispute, of stealing his ideas, but historians now believe that each invented calculus independently.

Newton was made a knight by Queen Anne in 1705. At his death in 1727, he was buried in London's Westminster Abbey. Shortly before he died, Newton remarked:

I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or prettier shell than ordinary, while the great ocean of truth lay all undiscovered before me.

Quiz

- 1 Which of the following statements BEST describes Newton's contribution to science?
- (A) He invented the field of physics.
 - (B) He developed theories others have proven.
 - (C) He created a method for teaching calculus in a simple and effective way.
 - (D) He laid the foundation for comprehending how the Universe works.

- 2 Based on the article, which of the following options BEST characterizes Newton?
- (A) He was remarkably skilled, curious, and outgoing.
 - (B) He was extremely smart, confident, and devoted.
 - (C) He was incredibly talented, focused, and gregarious.
 - (D) He was highly intelligent, inquisitive, and persistent.

- 3 Read the following sentence from the section "Early discoveries."

His lectures bored many of his students, but he continued his own thinking and experiments, undaunted.

Which of the following options is CLOSEST in meaning to the word "undaunted" as used in the sentence?

- (A) with audacity
- (B) with trepidation
- (C) without recognition
- (D) without discouragement

- 4 Read the following sentence from the section "Calculus."

Newton accused Leibniz, in a nasty dispute, of stealing his ideas, but historians now believe that each invented calculus independently.

Which of the following words BEST matches the tone of the word "dispute"?

- (A) feud
- (B) debate
- (C) commotion
- (D) controversy

Answer Key

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